



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/708,748	03/23/2004	Wei Lu	FIS920030308	2747

29154 7590 03/09/2007  
FREDERICK W. GIBB, III  
Gibb & Rahman, LLC  
2568-A RIVA ROAD  
SUITE 304  
ANNAPOLIS, MD 21401

EXAMINER
----------

JOHNSTON, PHILLIP A

ART UNIT	PAPER NUMBER
----------	--------------

2881

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	03/09/2007	PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

# Office Action Summary

Application No.

10/708,748

Applicant(s)

LU ET AL.

Examiner

Phillip A. Johnston

Art Unit

2881

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 23 August 2006.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-3,5-10 and 12-20 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-3,5-10 and 12-20 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 23 March 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- ☐ Notice of Informal Patent Application
- ☐ Other: \_\_\_\_\_

***Detailed Action***

1. This Office Action is submitted in response to the appeal brief filed 8-23-2006, wherein claims 1-3,5-10, and 12-20 are pending.

2. The examiner agrees with those arguments presented in the applicants appeal brief regarding the examiners failure to clearly point out each and every limitation of the applicants claimed invention. As a result, the rejections in the previous Office Action are withdrawn, and a new Office Action is submitted below which will more clearly define the examiners position.

***Claims Rejection – 35 U.S.C. 103***

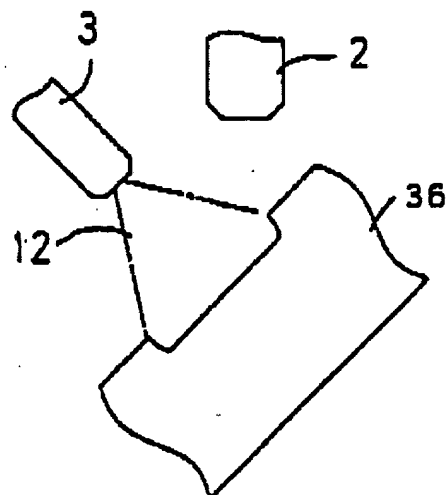
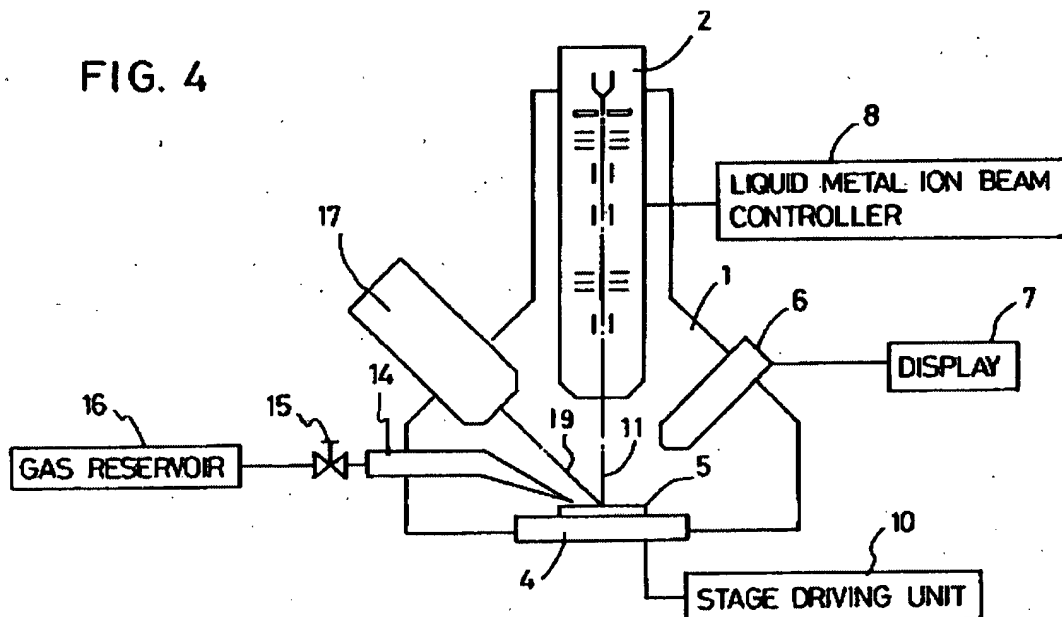
3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 1-3,5-10, and 12-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 5,574,280, to Fuji, and Nikoonahad, U.S. Patent No. 6,633,831, in view of Berger, U.S. Pat. Pub. No. 2004/0065826.

5. Regarding claim 1, Fuji teaches a method of using angled electron beam irradiation unit 17 to irradiate hexacarbonyl tungsten gas (organic metal gas) blown by the organic gas source 14 onto the surface (top layer) of semiconductor device 5 (Note

Figure 4 below), thus forming a tungsten film on the surface by the CVD process. A portion of the sample 5 is removed by ion beam sputtering (Note Figure 6B below) at the predetermined area (forms a groove), exposing a cross-section of the semiconductor surface, which is then imaged on display 7 (for inspecting the exposed area). Column 2, line 40-49; Column 4, line 34-45; Column 5, line 47-57; and Figure 4 below.



6. Fuji teaches all the structural limitations of claim 1, as pointed out above.

7. Fuji fails to disclose directing an angled electron beam to strike the sidewalls of topographical features.

8. Nikoonahad teaches the use of an angled energy beam 44 (Note Figure 4) to irradiate the sidewalls of topographical features formed on the surface of a semiconductor specimen (Note Figure 8 below). Col. 41, line 52-59; Col. 55, line 12-25; Col. 37, line 57-67; and Col. 38, line 1-15.

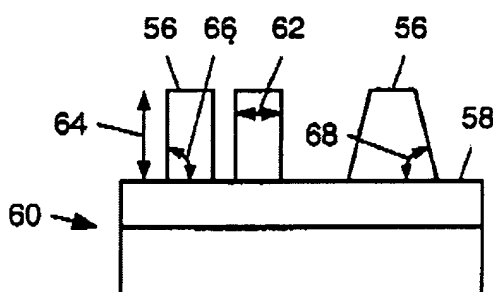


Fig. 8

9. Nikoonahad modifies Fuji to irradiate the sidewalls of topographical features with an energy beam in order to deposit a layer on the sidewalls and measure dimensions and/or roughness. Col. 154, line 25-45.

10. Therefore it would have been obvious to one of ordinary skill in the art that the sample surface processing and imaging method of Fuji can be modified for irradiating topographical features in accordance with Nikoonahad, to provide a CVD atomic layer deposition tool coupled to metrology and inspection tools for reducing variance in sidewall dimensional distributions on a specimen, thereby providing tighter process control of a semiconductor fabrication process.

11. The combination of Fuji and Nikoonahad teaches all the structural limitations of claim 1 above, but fails to teach the use of secondary electrons to break down the precursor metal gas to form a metal coating. The examiner takes Official Notice that it is well known for an electron beam to dissociate the metal gas as a result of secondary electrons to form a metal coating in the CVD process. See USPN 4,509,451 to Collins. Therefore one of ordinary skill would have used the dissociation (breakdown) of gas molecules resulting from the secondary electrons emitted from ionizing collisions between the electron beam and the gas molecules in the electron beam CVD process of Fuji to form a metal film from the metal gas.

12. Regarding claims 2 and 3, the rationale applied above to claim 1 also applies to claims 2 and 3. It is also interpreted from Figure 6B in Fuji that the sample stage is tilted to provide a desired angle of incidence to a sidewall. See Figure 6B above.

13. Regarding claims 5 and 6, the combination of Fuji and Nikoonahad teaches all the required limitations therein as described above regarding claim 1, but fails to teach the use of electron beams having energy levels between 100 and 10,000 electron volts, which are higher than the secondary electrons they create. The examiner takes Official Notice that it is well known to use such energy levels to create secondary electrons. See USPN 6,052,401 to Wieser; and USPN 3,119,707 to Christy. Therefore one of ordinary skill would have used electron beams having energy levels between 100 and 10,000 electron volts to generate secondary electrons at lower energies (due to energy loss during collision) to dissociate gas molecules.

14. Regarding claim 7, Fuji and Nikoonahad teach all the structural limitations of claim 7 as applied above to claim 1 but fails to teach the use of incident beam angles between 20 and 70 degrees.

15. Berger teaches a particle-beam system 10 for obtaining an image of a cross-section of workpiece 11 (Note Figure 1 below). The electron beam column 20 is canted relative to the first axis 18 so that it intersects the first axis 18 at a selected angle preferably between thirty and sixty degrees. See paragraph's [0024], [0025]; and [0039].

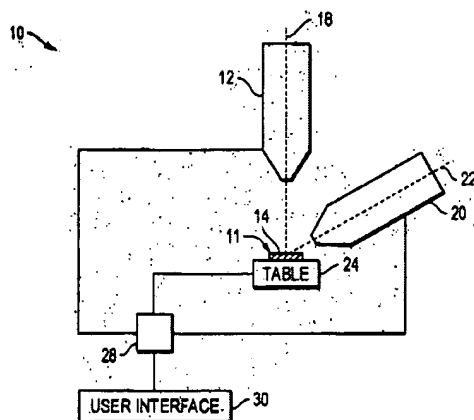


FIG. 1

16. Berger modifies Fuji and Nikoonahad to provide an electron beam at an incident angle between thirty and sixty degrees.

17. Therefore it would have been obvious to one of ordinary skill in the art that the ion beam apparatus and method of Fuji and Nikoonahad can be modified to use the incident electron beam angles specified in the apparatus and method of Berger, to provide a method and system for imaging a cross-section of a substrate that is

capable of switching from a cutting mode to an imaging mode in order to view the vertical wall of the excavated cross-section.

18. Regarding claim 8, the rationale applied above to claim 1, also applies to claim 8. Fuji further teaches that a sample semiconductor device is processed and/or observed with the focused liquid metal ion beam, then returned again to the manufacturing process, which is equivalent to the use of a partially completed integrated circuit structure. See Abstract.

19. Regarding claim 9, the rationale applied above to claims 2 and 8, also applies to claim 9. In addition, it is implied in the teachings of Fuji and Nikoonahad above regarding irradiating the sidewall that an angle would be selected to prevent the beam from striking the bottom of a topographical feature.

20. Regarding claim 10, the rationale applied above to claims 3 and 8, also applies to claim 10.

21. Regarding claims 12 and 13, the rationale applied above to claims 5 and 6, also applies to claims 12 and 13.

22. Regarding claim 14, the rationale applied above to claims 7 and 8, also applies to claim 14.

23. Regarding claim 15, the rationale applied above to claim 8, also applies to claim 15.

24. Regarding claim 16, the rationale applied above to claims 9 and 15, also applies to claim 16.



25. Regarding claim 17, the rationale applied above to claims 3 and 15, also applies to claim 17.

26. Regarding claims 18 and 19, the rationale applied above to claim 15, also applies to claims 18 and 19.

27. Regarding claim 20, the rationale applied above to claims 7 and 15, also applies to claim 20.

### ***Conclusion***


28. Any inquiry concerning this communication or earlier communications should be directed to Phillip Johnston whose telephone number is (571) 272-2475. The examiner can normally be reached on Monday-Friday from 7:30 am to 4:00 pm. If attempts to reach the examiner by telephone are unsuccessful, the examiners supervisor Robert Kim can be reached at (571)272-2293. The fax phone number for the organization where the application or proceeding is assigned is 571 273 8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

PJ

December 5, 2006

  
**ROBERT KIM**  
SUPERVISORY PATENT EXAMINER

  
David A. Vance  
Primary Examiner  
Art Unit 2881